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The Returns to Entrepreneurship: Evidence from Matched Person-firm Data

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ABSTRACT: Empirical studies show low pecuniary returns of switching from wage employment to entrepreneurship. We reconsider the pecuniary gains of this switching by employing a two-stage procedure, where the randomness in the timing of inheritance transfers is used as an exclusion restriction to identify causal effects. The model is estimated on data covering the whole Norwegian population of individuals matched to the entire population of firms established in the period 2002–2011. The results indicate that the average returns to entrepreneurship are significantly negative for individuals entering entrepreneurship through self-employment and modest, but significantly positive, for incorporated startups.

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1 Introduction

A large literature has emerged examining returns to entrepreneurship (Astebro, 2010; Astebro and Chen, 2014; Berkhout et al., 2016). A seminal contribution is Hamilton (2000), who examines differences in the earnings distribution of wage-earners and self-employed persons using a traditional Mincer-type earnings equation framework. He finds that entrepreneurs have, cet. par., lower initial earnings and lower earnings growth than wage-earners and that their earnings distribution exhibits wider dispersion. Hamilton also shows that the earnings differential is not due to self-selection of low ability employees into entrepreneurship. The consensus based on Hamilton's study and follow-up studies is that the pecuniary returns to entrepreneurship are not the driving force of an individual's decision to switch from wage employment to entrepreneurship (Astebro, 2010; Astebro and Chen, 2014). Four sets of discussions to better understand this "entrepreneurial earnings puzzle" have developed since.

The first is that non-pecuniary benefits from entrepreneurship must be substantial (e.g., Benz and Frey, 2008; Blanchflower and Oswald, 1998; Carter, 2011; McCraffrey, 2014). Second, other factors than mere rational expectations might lead to the choice of entrepreneurship such as genetic and environmental factors (Lindquist et al., 2015; Nicolaou et al., 2008) or cognitive biases (Holm et al., 2013) arising from, for instance, overoptimism (Lowe and Ziedonis, 2006; Dushnitsky, 2010) and/or overconfidence (Hayward et al., 2006) or a lower level of risk or loss-aversion (Hvide and Panos, 2014; Koudstaal et al., 2015).

Third, researchers have also attributed the lack of evidence of an effect of entrepreneurial income to the low quality of entrepreneurial income data (Parker, 2009). Indeed, measuring business incomes is notoriously difficult due to a lack of unequivocal accounting and reporting methods and misreporting (Astebro and Chen, 2014; Astebro, 2010; Feldman and Slemrod, 2007; Hurst et al., 2013). Moreover, the range of possible outcomes is much wider and often not even foreseeable due to risk and uncertainty (Astebro, 2010, Parker, 2009, Hamilton, 2000). No doubt, the lack of a uniform concept of entrepreneurial income is also a problem for individuals who consider starting up a venture. Supporting this idea, Berkhout et al. (2016) show for a Dutch sample of young college and university graduates that decisions to become entrepreneurs are indeed not associated with the entrepreneurial income prospects. However, the decision to become an entrepreneur is affected significantly by the income prospects in wage-employment in their labor market segment, i.e., the better observable and measurable opportunity costs of entrepreneurship.

Fourth, a new perspective is provided based on the debate about 'who is an entrepreneur?'. This perspective suggests the use of 'stricter' definitions of entrepreneurship, thereby weeding out from the sample "necessity" entrepreneurs and those self-employed who typically earn low incomes and experience little growth. The resulting population of entrepreneurs would be more representative of the population of true 'Schumpeterian' entrepreneurs. Definitions that have been used for this purpose are, for instance, incorporated entrepreneurs (Levine and Rubinstein, 2016), positive entrepreneurs, i.e., movements from wage-employment to entrepreneurship (thereby ignoring entrepreneurship originating from unemployment; see Berglann et al., 2009), or even billionaire entrepreneurs (Henrekson and Sanandaji,

2014). Levine and Rubinstein show that incorporated business owners earn, on average, more than both unincorporated (self-employed) business owners and ordinary wage workers. Wage workers earn, in turn, more than self-employed workers.

The main aim of our analysis is to contribute to a better analysis of the pecuniary returns to entrepreneurship than currently available in the literature using a comprehensive data set that comprises administrative records for the whole population of Norwegian individuals and firms (both corporated and unincorporated). Our panel data set covers the period from 2001 to 2011, where we can observe the initial earnings for given individuals before they become entrepreneurs. In our analysis, we employ as the initial condition that the person is an employee in 2001. Hence, we can focus on positive 'opportunity' entrepreneurship: people who give up a job to become an entrepreneur. In contrast, self-employment as an alternative to unemployment or social benefits is likely to be less influenced by future earnings prospects, and should be considered separately (Hvide and Panos, 2014). Second, we observe very detailed measures of both employment and entrepreneurship incomes in the registry. For the latter we have detailed information on share ownership and valuation leading to the possibility of measuring firm value growth and income from ownership in the case of incorporation (see also Hvide and Møen, 2010, using similar Norwegian registry data). We acknowledge the self-selection problem and analyze to what extent earlier findings are obscured by mixing individuals who become entrepreneurs without interesting wage alternatives (low ability) with those who do have a realistic alternative opportunity (high ability).

A number of studies have argued that potential entrepreneurs may be discouraged by low initial wealth or borrowing constraints. For example, Corradin and Popov (2015) find evidence that increased value of home equity encourages entrepreneurship through a "collateral channel", allowing potential entrepreneurs to borrow more against their property value. Similarly, as argued by e.g., Holz-Eakin et al. (1994), receipt of an inheritance may reduce liquidity constraints and affect the probability of starting up a new business. According to Blanchflower and Oswald (1990) and Holtz Eakin et al. (1994), the receipt of an inheritance is about as close to a "natural experiment" as one is likely to get in entrepreneurship research. Although people may anticipate a future inheritance and take that into consideration when deciding labor market and investment decisions, the *timing* of the receipt of an inheritance may not be predictable.

Bø et al. (2016) estimate significant effects on the labor supply adjustments of wage earners after obtaining a major bequest – but not before – on Norwegian registry data. They conclude that at least some recipients time their labor market responses to the timing of bequest. In line with their approach, we include in our analysis dummy variables indicating the timing of bequest as identifying instruments (assumed to affect whether a person switches from wage employment into entrepreneurship in a given year, but not earnings). We expect that the probability of starting up one's own business increases in the period just after the actual transfer of an inheritance: some beneficiaries may be liquidity constrained before the actual transfer, or risk averse recipients will avoid tapping into future funds. Since incorporated entrepreneurship carries a reasonable large fixed fee compared to running a sole proprietorship and also is more costly and complicated from an accounting and legal perspective, we distinguish between incorporated and unincor-

porated (self-employed) entrepreneurs.

Our estimation model has the following features: (i) It uses a random effects probit framework to identify whether persons who have a high general income ability are the ones who choose to become entrepreneurs ("selection by absolute advantage"). We measure income ability as the part of the income which is unchanged over time, irrespective of the choice to become an entrepreneur. (ii) It can be used to assess the average *return* to entrepreneurship for those who become entrepreneurs, i.e., the increase in their earnings by becoming entrepreneurs, compared to remaining wage earners ("the average treatment effects on the treated"). (iii) It allows the entrepreneurial and wage income distributions to differ both in terms of their expected value and their variance. (iv) The choice to become an entrepreneur is considered endogenous with respect to income prospects.

Using this combination of data and model improvements, we show that the return to entrepreneurship is indeed positive when using a stricter definition of the entrepreneur. While the average return to entrepreneurship is significantly negative for individuals entering entrepreneurship through self-employment (even if some of them later incorporate their firm), entrepreneurs who establish firms by starting up an incorporated firm, have a significantly positive return to entrepreneurship, which we estimate to be around 5 percent on average.

The remainder of the paper is organized as follows. In Section 2 we discuss the modelling framework and in Section 3 the data. In Section 4 we discuss the results. Section 5 concludes.

2 The modelling framework

In this section we specify the earnings equation and the choice equation of whether to become an entrepreneur. In principle, we could use our panel data set to study transitions both into and out of entrepreneurship over time. However, to simplify the analysis, we will focus on one type of transition: from initial full-time employment in 2001, defined as 30 hours or more per week, to entrepreneurship in any of the years 2002-2011. The initial condition, that the individual is a full time wage earner excludes unemployed individuals from the sample. In doing so, we are likely to concentrate on positive entrepreneurship choices rather than necessity or defensive entrepreneurship. Otherwise, it is difficult to study the relative returns to the choice for entrepreneurship.

The discrete choice model assumes that the decision to become an entrepreneur is related to the initial characteristics of the individual and exogenous shocks that may occur during the observation interval, such as the receipt of an inheritance. We do not only consider whether or not the person becomes an entrepreneur in the given period, but also the timing of events (the *year* of transitions from one state two another). Some will become entrepreneurs late in the 10-year period, and we may follow them as entrepreneurs only for a year or two. Those who make the transition early can potentially be observed for a longer time – but some of them will exit entrepreneurship before the period is over. When a transition occurs, there will be a shift in the earnings equation. The endogeneity of the decision to become an entrepreneur means that pre- and post- decision earnings may be correlated with the

decision to become an entrepreneur (this is called selection on non-treated outcomes in the evaluation literature). Of course, a large majority of wage earners never become entrepreneurs.

2.1 Stochastic specification

The state of individual i at time t is denoted $Ent(i,t) \in \{0,1\}$, where $Ent(i,t) = 1$ means that the individual is an entrepreneur at time t and $Ent(i,t) = 0$ means that he is not. All individuals enter the sample at $t = 0$, with the initial state being $Ent(i,0) = 0$, i.e., they are full time wage earners. We define the time of transition from wage-employment to entrepreneurship, T_i, as:

$$T_i = \min_t : \; Ent(i,t) = 1$$

The binary choice variable, E_i, is defined as $E_i = 1$ iff $T_i \leq T$ and 0 else

$$E_i = \left\{ \begin{array}{cc} 1 & \text{if } T_i \leq T \\ 0 & \text{else} \end{array} \right\}.$$

Thus E_i is an indicator that the person becomes an entrepreneur within the interval $[0,T]$. A typical event history may be i) $Ent(i,t) = 0$ for all t (the person remains a wage earner), ii) $E(i,t)$ jumps from 0 to 1 at t' (entry into entrepreneurship) and remains in this state, and iii) $E(i,t)$ drops back from 1 to 0 at $t'' > t'$ (exit from entrepreneurship). See Section 3 for exact operationalizations.

To model the time of transition, T_i, we propose a model which is a dynamic extension of the two-sector model of Heckman and Sedlacek (1990): Let X_{it}^* be a latent index representing both individual i's preferences and his opportunities with respect to becoming an entrepreneur in year t on a continuos scale. The endogenous choice variables E_i and T_i are assumed to be related to X_i^* through the relation

$$\begin{aligned} E_i &= 0 \text{ iff } \{X_{i1}^* < 0, \ldots X_{iT}^* \leq 0\} \\ T_i &= t \text{ iff } \{X_{i1}^* < 0, \ldots, X_{i,t-1}^* < 0,\, X_{it}^* \geq 0\} \end{aligned} \tag{1}$$

That is, T_i is the first-passage time of the latent process X_{it}^* (the first time it hits the zero threshold). Furthermore, we assume that

$$X_{it}^* = Z_{1it}\gamma_1 + \sigma\varepsilon_{1i} + e_{it} \tag{2}$$

where Z_{1it} is a row-vector of both time invariant variables (e.g., gender and initial wealth) and time-varying exogenous variables (e.g., age and calendar year dummies) affecting the individual's choice, γ_1 is the corresponding coefficient vector, ε_{1i} is a random effect and e_{it} is the error term. Both ε_{1i} and e_{it} are assumed to be normally distributed random variables with zero mean and unit variance. Then (1)-(2) specify

a random effects probit model for the binary choice variable $1(X_{it}^* > 0)$:

$$\begin{aligned}\Pr(T_i &= t|Z_{1i1},...,Z_{1it}) = \Pr(X_{i1}^* \leq 0,..., X_{it-1}^* \leq 0, X_{it}^* > 0) \\ &= \int \Phi(Z_{1it}\gamma_1 + \sigma\varepsilon_{1i}) \prod_{s<t} \Phi(-[Z_{1it}\gamma_1 + \sigma\varepsilon_{1i}])\phi(\varepsilon_{1i})d\varepsilon_{1i}\end{aligned}$$

which we estimate using the methods of maximum likelihood (see Appendix).

It is assumed in (2) that ε_{1i} and e_{it} are uncorrelated with Z_{1it}. This assumption is justified on the grounds that we are not interested in the causal effect of the explanatory variables on the choice to become an entrepreneur per se, e.g., the effects of educational attainments. However, we will allow ε_{1i} to be correlated with earnings. That is, any unobserved variable that affects the entrepreneurship decision is allowed to influence earnings. This creates a self-selection problem that will be addressed below.

Our equation of main interest is the earnings relation. Let the index i denote individual i, and $Y_{it}(0)$ and $Y_{it}(1)$ log earnings if individual i at t when $Ent(i,t) = 0$ and $Ent(i,t) = 1$, respectively. Hence, log earnings for a person who becomes an entrepreneur at t, switches from $Y_{i,t-1}(0)$ at $t-1$ to $Y_{it}(1)$ at t. We assume that

$$\begin{aligned}Y_{it}(0) &= Z_{2it}\gamma_2 + \varepsilon_{2i} + u_{it}(0) \\ Y_{it}(1) &= \beta_i + Z_{2it}\gamma_2 + \varepsilon_{2i} + u_{it}(1) \qquad (3)\end{aligned}$$

where β_i is the shift in income when person i changes from being a wage earner to an entrepreneur and Z_{2it} is a vector of explanatory variables. Z_{2it} includes (powers) of years of experience[1], calendar time dummies, and components of Z_{i1t}. Finally, ε_{2i} is a person-specific random effect, whereas $u_{it}(0)$ and $u_{it}(1)$ are the idiosyncratic error terms in state $Ent(i,t) = 0$ and $Ent(i,t) = 1$, respectively, with possibly different distributions.

To allow heterogeneity, β_i is an individual-specific coefficient, with

$$E(\beta_i|E_{nt}(i,t) = 1) = E(\beta_i|E_i = 1) = \beta. \qquad (4)$$

That is, β is the average treatment effect on the treated. It is not required by our model that an individual's returns to entrepreneurship, β_i, are uncorrelated with observed characteristics. The returns to entrepreneurship may depend on any vector of time-invariant characteristics, X_i (including variables from Z_{1it}), in the following general way:

$$\beta_i = g(X_i) + \eta_i^*,$$

where $g(X_i)$ is some unknown regression function and η_i^* satisfies $E(\eta_i^*|X_i, T_i) = 0$. Then $ATT = E(g(X_i) + \eta_i^*|E_i = 1) = E(g(X_i)|E_i = 1) \equiv \beta$. What *is* assumed by our model is that both entrepreneurs and non-entrepreneurs have the same returns to observed characteristics in *wage-employment*.

The (hypothetical) earnings difference for the same person i in state 1 and 0

[1] Experience is measured as age minus years of schooling (minus seven years), and thus reflects *potential* experience.

(Δ_{it}) equals

$$\Delta_{it} = \beta_i + u_{it}(1) - u_{it}(0).$$

The average earnings difference (average treatment effect) is

$$AT \equiv E(\beta_i) \tag{5}$$

and the average treatment effect given treatment is

$$ATT \equiv E(\Delta_{it}|E = 1) = E(\beta_i|E_i = 1) = \beta. \tag{6}$$

Note that the average observed earnings differentials between entrepreneurs and non-entrepreneurs (OD) – everything else equal – is given by

$$OD \equiv ATT + E(\varepsilon_{2i}|E_i = 1) - E(\varepsilon_{2i}|E_i = 0). \tag{7}$$

This shows that the correlation between the additive individual effect in the earnings equation (ε_{2i}) and the error term in the choice equation (ε_{1i}) prevents us from estimating ATT simply from observed earnings differentials between entrepreneurs and non-entrepreneurs (even if we control for differences in observed variables). The bias may be positive or negative: Those with a higher earnings potential regardless of entrepreneurship may tend to become entrepreneurs (such positive correlation between ε_{2i} and ε_{1i} can be interpreted as selection by *absolute advantage*), or they may tend to remain wage earners (negative correlation). Thus it is adamant to be able to control for self-selection when making inferences about treatment effects.

To address selection effects discussed above, we allow ε_{1i}, ε_{2i} and β_i to be correlated random variables. However, since we will not attempt to estimate AT, which can only be identified with much stronger restrictions than needed to identify ATT, we do not explicitly model these correlations, e.g., between ε_{1i} and β_i (more about this below). To estimate equation (3), we will condition on the choice variable E_i, and obtain expressions for the conditional expectations of ε_{2i} given E_i. To do so, we first note that we can write

$$\varepsilon_{2i} = \theta_1 \varepsilon_{1i} + \widetilde{\varepsilon}_{2i}, \tag{8}$$

where $\widetilde{\varepsilon}_{2i}$ and ε_{1i} are independent and

$$E(\varepsilon_{1i}\varepsilon_{2i}) = \theta_1. \tag{9}$$

Defining $Y_{it} = Y_{it}(E(i,t))$ and $u_{it} = u_{it}(Ent(i,t))$, the observed time series is

$$Y_{it} = \beta_i Ent(i,t) + Z_{2it}\gamma_2 + \varepsilon_{2i} + u_{it}. \tag{10}$$

Only one of the potential outcomes $Y_{it}(0)$ and $Y_{it}(1)$ is observed – the other is a counterfactual outcome. To estimate (10), given that $Ent(i,t)$ is endogenous and depends on ε_{2i}, we apply a control function approach, in the tradition of Heckman (1979) and Garen (1984). In Proposition 1 we derive auxiliary variables (ξ_i) to account for the correlation between $Ent(i,t)$ and ε_{2i}. The auxiliary variables are computed from the random effects probit analysis and included as control functions

in the earnings equation (3). The original earnings equation can then be transformed into an equation with a genuine random effect that is uncorrelated with the explanatory variables.

Proposition 1 *Assume that* $(\varepsilon_{1i}, \varepsilon_{2i})$ *is binormally distributed with zero mean and satisfies the conditions (8)-(9) and assume that* T_i *is determined by the random effects probit model (1)-(2). Moreover, define*

$$T_i^* = \begin{cases} T_i & \text{iff } T_i \leq T \\ 0 & \text{iff } E_i = 0 \end{cases} \tag{11}$$

Then

$$E(\varepsilon_{1i}|T_i^* = t) = \xi_i(t),\ t = 0, 1, 2, ...$$

where

$$\xi_i(0) = \frac{1}{P(T_i^* = 0)} \int \prod_{s \leq T} \Phi(-\left[Z_{1is}\gamma_1 + \sigma\varepsilon_{1i}\right])\phi(\varepsilon_{1i})d\varepsilon_{1i}$$

and

$$\xi_i(t) = \frac{1}{P(T_i^* = t)} \int \varepsilon_{1i}\Phi(Z_{1it}\gamma_1 + \sigma\varepsilon_{1i}) \prod_{s<t} \Phi(-\left[Z_{1is}\gamma_1 + \sigma\varepsilon_{1i}\right])\phi(\varepsilon_{1i})d\varepsilon_{1i},\ t = 1, 2, ...\ .$$

The proof is stated in the Appendix. It follows that we can express (10) as:

$$Y_{it} = \beta Ent(i,t) + \delta_i Ent(i,t) + Z_{2it}\gamma_2 + \theta_1\xi_i(T_i^*) + \varepsilon_i^* + u_{it} \tag{12}$$

with

$$\begin{aligned} \delta_i &= \beta_i - \beta \\ \varepsilon_i^* &= \varepsilon_{2i} - \theta_1\xi_i(T_i^*) \end{aligned}$$

and where ε_i^* is a random effect with the property: $E(\varepsilon_i^*|E_i = e) = 0$. A positive θ_1 (positive correlation between ε_{1i} and ε_{2i}) can be interpreted as "selection by absolute advantage". We allow the variance in the distributions of the random effect, ε_i^*, to differ between the two groups, as well as an autoregressive structure in the error term, u_{it} :

$$\begin{aligned} &Var(\varepsilon_i^*|E_i = e) = \sigma^2(e),\ e = 0, 1 \\ &u_{it} = \phi u_{i,t-1} + \eta_{it}, \eta_{it} \sim i.i.d(0, \sigma_\varepsilon^2). \end{aligned}$$

Equation (12) is a *mixed* model because it allows both the estimation of an average effect of entrepreneurship, β $(= ATT)$, and idiosyncratic variations, δ_i, in this effect at the individual level (measured as deviations from ATT). To estimate β consistently by mixed models methods, the following standard assumptions must hold:

Assumption 1 $E(\delta_i u_{it}) = 0$ for all t

Assumption 2 $E(\delta_i\ Ent(i,t)) = 0$ for all t

Assumption 3 $E(u_{it}Ent(i,t)) = 0$ for all t

Assumption 1 says that the firm-specific effect of the treatment (measured as a deviation from ATT) cannot depend on any of the genuine error terms. Assumption 2 is satisfied given our previous assumptions: Given (4), $E((\beta_i - \beta)|Ent(i,t) = 1) = E(\delta_i|Ent(i,t) = 1) = 0$. Moreover,

$$E(\delta_i|Ent(i,t) = 1) = 0 \Rightarrow E(\delta_i Ent(i,t)) = 0. \tag{13}$$

Assumption 3 comes down to independence of the treatment from the genuine error term, i.e., the random fluctuations in earnings. This is achieved by including the control function $\xi_i(T_i^*)$ as a linear regressor into the model to capture the selection effects. Note, however, that the model allows δ_i to be correlated with ε_i^* (the person effect).

To identify the structural parameters associated with the returns to entrepreneurship, a key issue is exclusion restrictions (exogenous variation in the discrete choice variable).[2] As have been pointed out by many authors, capital market constraints may be an important determinant of the decision to become an entrepreneur (see e.g., Holtz Eakin et al. 1994). If access to capital is important to starting a business, then those who receive a lump sum of capital should have a higher probability of doing so. As discussed in the Introduction, we will implement one type of exclusion restrictions: dummy variables indicating the timing of inheritance. These are assumed to affect the entrepreneurship choice (the relevance criterion) but not earnings.

3 Definitions and data

The entrepreneur Most empirical studies have measured entrepreneurship in terms of self-employment. This has lately become a much debated choice (Levine and Rubinstein, 2016; Henrekson and Sanandaji, 2014). A concept of entrepreneurship that does not include incorporated firms will miss out on the most successful entrepreneurs. Official statistics confirm that self-employment has not been an important source of labor income growth in Norway during the last decades, in contrast to wage- and business income from incorporated firms.[3]

Using Norwegian registry data, Berglann et al. (2011) invoke a wider definition of entrepreneurship. An entrepreneur is either employed in a firm in which (s)he is a major/active owner (with at least 30% ownership or a combination of at least 10% ownership and being a board member or a chief executive) or who runs his or her own business as a sole proprietor. In other studies using Norwegian registry data, Hvide (2009) and Hvide and Panos (2014) define an entrepreneur as an individual with a majority stake, i.e., more than 50% of the total shares, in a newly established incorporated company.

We distinguish two types of 'entrepreneurship': self-employment and incorpo-

[2] Within our framework such restrictions are not formally needed to obtain identification.

[3] See Fjærli et al., 2013, Figure 1.

ration.[4] Similar to Berglann et al. (2011), we define an entrepreneur based on a combination of ownership and control in a company. The entrepreneur must have at least a blocking minority position in a privately held limited liability company (at least 33%) and, at the same time, must be either an employee or have a formal management role (CEO, chairman of the board, or both) during start-up. The 33% threshold includes both direct and indirect ownership positions in the firm (more about this below)[5]. The choice of a threshold necessarily involves some arbitrariness, but our criteria ensure that the entrepreneur retains a certain degree of control over the firm and, at the same time, is an active owner. For entrepreneurs in the sense of self-employment, we require that they run their own business as a sole proprietor. For both types of entrepreneurship, we require that the firm is new. That is, persons who become owner-managers or sole proprietors of already existing firms (e.g., who take over a family business) are not classified as entrepreneurs.[6] Our econometric framework can be used to estimate an average treatment effect, β (relative shift in income), for all entrepreneurs irrespective of whether they are incorporated or self-employed.

The earnings measure Total earnings defined as the sum of labor income and ownership income from the entrepreneur's own firm must be included when estimating the pecuniary returns to entrepreneurship.[7] The earnings of an entrepreneur will typically consist of both returns to invested financial capital (equity) and returns to human capital (labor and effort).[8] The opportunity cost of an entrepreneur therefore consists both of a labor cost component and a capital cost component and this needs to be taken into consideration when assessing the returns to entrepreneurship. To address these issues we propose a uniform measure of (pretax) earnings for all individuals in the sample, whether self-employed, wage-employed, unemployed or owner-managers of incorporated firms. It is the sum of labor income (from wages and self-employment), work-related cash transfers (such as unemployment benefits and short-term sickness benefits) and owner income from incorporated firms in which the individual is an entrepreneur. The latter is denoted "entrepreneurial

[4] Owners of incorporated firms are obliged to inject a minimum capital of 100,000 NOK at start-up and they have no personal liability for the company's obligations.

[5] We acknowledge that the decision to start an incorporated firm is sometimes motivated by tax planning, rather than entrepreneurship. At the same time, self- employment may be a close substitute for wage employment, typically in the low end of the wage distribution and may also have little to do with entrepreneurship in the classical, Schumpeterian sense.

[6] An entrepreneur may still be a wage earner in another firm than where (s)he is an owner-manager.

[7] In most cases, the owner–manager will have full control and can easily transfer equity in and out of the firm without regarding the preferences of other shareholders and conflicts of interest. This also means that the entrepreneur can decrease (increase) the level of profit in the firm by increasing (decreasing) her own wage, possibly motivated by tax concerns (Astebro and Chen, 2014; Astebro, 2010; Feldman and Slemrod, 2007; Hurst et al., 2013).

[8] Realized business income (such as dividends) from corporate firms is not a good measure of entrepreneurial earnings. One reason is that dividends are vulnerable to changes in taxation rules.This is of particular importance for Norway where the pre-announced tax reform of 2006, for instance, led to a huge step-up of dividend payments in 2005, and a sharp decline in the subsequent years. Also in 2002, when an increase in dividend taxation was largely expected, there was a bust in dividend payments in an otherwise poor year for business owners.

owner income".[9] Entrepreneurial owner income is allocated to the owners of a firm in proportion to their ownership share, and is defined as total taxable profit in a specific year *after subtracting a normal rate of return to the firm's equity* (injected equity plus accumulated retained earnings). The latter is done to account for the opportunity cost of invested financial capital, which should not be counted as a part of the return to entrepreneurship (cf. Parker, 2009). The normal return is simply set to 4% which was the average (nominal) yield on 10 year government bonds during 2001-2011.

Our approach is in the spirit of Hamilton (2000), but is based on longitudinal rather than cross section data. Moreover, we have much more detailed accounting and ownership information both at the firm and person level.

Identification of owners and ownership shares in the registry We focus on private firms registered under the organizational forms AS (aksjeselskap/private limited liability company/incorporated firm) and ENK (sole proprietorship/self-employment) between 2001 and 2011. We use data from different registers, covering the entire population of firms and owners. These are:

- The Household register. This register includes a wealth of information about individuals and households obtained by merging several primary registers. It contains annual information about income, wealth, education, and demographic variables, including identification numbers of individuals' spouses and relatives, for all persons above the age of 18 with permanent residency in Norway.

- The Directorship register. This provides details for each individual appointment in positions such as general manager, chairman or member of the board for AS firms and sole proprietors in the case of ENK firms.

- The Register of Employers and Employees. This contains data on employment contract durations, wage and contractual working hours for each employee, including sole proprietors (ENK firms).

- The Shareholder register. This register provides information about owners (both individuals and firms) and their shareholdings from 2001 and onwards.[10]

- The Accounts statistics. This register contains data from the financial statements of AS firms.

- The Central register of establishments and enterprises, with information about the establishment and termination of all registered firms (date of establishment, date of closure, reason for closure (e.g., bankruptcy, merger, overtaken by another firm, or unspecified). The register also includes information on the firm's industry (4-digit NACE), number of employees, turnover (total sales) and location.

[9] Unlike Berglann et al. (2011), we do not include general capital income in our earnings measure, because it is a return on a portfolio investment, not entrepreneurial effort.

[10] Measures are slightly different for the 2001-2003 period due to a shift in data source.

We use the Directorship register to identify the sole proprietor and the Central register of establishments and enterprises to match the individual sole proprietor to a new firm. The register of establishments and enterprises includes a binary activity code (active or non-active) assigned by Statistics Norway; an active firm is required to have registered some form of economic activity, such as positive turnover (total sales income) or payments of value added tax. Newly established firms without registered activity are not classified as established before they become active. Inactive firms are removed from the analysis. This applies both to AS and ENK-firms, but is especially important to ENK-firms (of which there is a higher share of inactive firms).

Identifying incorporated entrepreneurs is more complicated. We need to identify the owners of newly established firms and their ownership shares. Moreover, we need to determine whether they are employed in the firm or have an appointment in the firm as general manager, chairman or member of the board. An owners ownership shares in a company include both direct and indirect ownership through other firms (see Fjærli et al., 2013, for details).[11]

The procedure applied to identify ultimate owners enables us to differentiate between three levels of ownership. Level 1 represents direct ownership (the individual shareholder owns part of the firm directly), while levels 2 and 3 indicate indirect ownership (with, respectively, one and two firms acting as intermediaries between the ultimate owner and the firm).[12] We identify about 60% of the personal owners as direct owners, while the remaining 40% of the owners are identified as indirect owners (see Fjærli et al., 2013). Thus indirect ownership is highly important. After identifying the ultimate personal owners and their ownership shares, we merge the resulting databases with the Accounting statistics for the corresponding years to add a series of firm characteristics. In the resulting matched owner-firm data set, we keep only the firms for which accounting information exists. We also exclude owners that cannot be matched with the Households register.

Sample selection and descriptive statistics The first row of Table 1 shows the total number of individuals with a registered employment relationship in 2001 who established incorporated (AS) or unincorporated (ENK) firms (first and second pair of columns, respectively) in the subsequent period 2002-2011, as well as the reference population of working people, that is, with a registered employment relationship (including current entrepreneurs) according to the Register of employers and employees (third set of columns).[13] Hence the individuals counted in the third

[11] We identify a few cases of cross-ownership, where firms simultaneously hold shares in each other. Because it is difficult to accurately establish who the ultimate owner is in these cases, we exclude them from our study.

[12] For about 80% of the firms during 2001–2003 and 90% during 2004–2011, we identify all shareholders, indicating that most firms in Norway are owned directly or indirectly through only one or two intermediary firms. The difference between the two periods is due to the change in data sources, which enabled a more accurate identification of ultimate owners after 2003. Unidentified ownership shares may correspond to foreign or institutional investors. Foreigners cannot be identified through a Norwegian personal number, while institutions (such as enterprises in the public sector) or listed (ASA) firms are not included in our database.

[13] Holding companies (i.e., companies with an ownership share of minimally 90% in at least one other firm in their first or second year of activity) are excluded from the sample. We also exclude

pair of columns include the individuals counted in the first two sets of columns. The entrepreneurs that can be identified in the data are displayed in the first row of Table 1. There are 38,225 and 7,561 men and women, respectively, who become founders of new incorporated firms during 2002-2011. The second pair of columns shows that there are 83,961 men and 38,961 women who become sole proprietors of new firms during 2002-2011. Of the incorporated entrepreneurs in the whole population, 3,867 are first registered as self-employed, and therefore included among the self-employed entrepreneurs in Table 1.

Some of the individuals in the employee-population were owners of incorporated firms or self-employed already in 2001. For reasons discussed above, we exclude individuals who establish a firm, but are already entrepreneurs (e.g., serial entrepreneurs, or self-employed entrepreneurs who incorporate their firm). That is, we exclude individuals who are either i) registered as sole proprietors of existing ENK firms in 2001, or ii) have an ownership share exceeding 33% in an existing incorporated firm; see the second row of Table 1. In the third row, we also exclude individuals older than 62 years in 2001 and recipients of disability- or retirement pensions. Finally, we want to employ the initial condition regarding full-time employment in 2001. To operationalize the last requirement, we exclude persons who worked less than 30 hours per week on average in 2001. The numbers pertaining to this last exclusion restriction are found in the third row of the table. The numbers of valid entrepreneurs in the sample according to our definitions are shown in the bottom row of Table 1; columns 1–4. The final sample includes 15,459 male and 3,474 female incorporated entrepreneurs (direct transitions from employment to incorporated entrepreneurship) and 33,808 male and 10,495 female self-employed entrepreneurs. There is a considerable gender imbalance in the population of entrepreneurs. Only 18% of the incorporated entrepreneurs are women (compared to 43% in the population of full-time employed persons). Among the self-employed entrepreneurs, 24% are women. The last pair of columns in Table 1 shows that the population of individuals who potentially could make the transition from wage-employment consist of 544,883 men and 417,783 women and is referred to as the "Reference population". These are the individuals satisfying all criteria regarding employment status, age, and of not already being an entrepreneur in 2001 (as we have defined it). This sample forms the basis for estimating probit models explaining the transition from wage-employment to entrepreneurship.

A few remarks about the sample construction are in order. When estimating the earnings equation we do not condition on a person being either a full time employee or an active entrepreneur during the whole observation period (i.e., we do not condition on any *future* labor market outcomes when selecting the sample). If a person chooses to work fewer hours, or becomes voluntarily or involuntarily unemployed he remains in the sample (unemployment insurance is included in the labor earnings). However, to avoid complicating issues related to retirement decisions, we censor all earnings observations above the age of 65 years.[14] Moreover, we censor all

firms in Financial intermediation (NACE 10). These mostly have portfolio investments as their main activity. In addition, we exclude firms with an unspecified industry code and firms in the primary industries (Agriculture and Fishing), as is common in analyses of entrepreneurship.

[14] As shown by Berglann et al., 2011, entrepreneurs' retirement decisions are markedly different from the reference population.

Table 1: **Sample selection: Entrepreneurs and reference population**

	Incorporated entrepreneurs		Self-employed entrepreneurs		Reference population	
	Men	Women	Men	Women	Men	Women
Initial sample size	38,225	7,561	83,961	38,366	1,159,838	1,039,098
Persons excluded because they are:						
- already entrepreneurs	17,456	1,675	23,627	12,786	306,077	122,946
- above 62 years, or recipients of disability or retirement pensions	547	341	2,727	1,961	33,721	97,293
- part-time employees	4,763	2,071	23,799	13,124	275,157	401,076
Final sample size	15,459	3,474	33,808	10,495	544,883	417,783

Table 2: **Distribution of educational level among entrepreneurs and in the reference population.** In percent

Education level	Incorporated	Self-employed	Population
Primary school or lower secondary education (10-)	13	20	20
Post-secondary education (11-13)	49	46	48
Lower tertiary (14-17)	26	21	24
Higher tertiary and Phd (18+)	11	11	7
N (in final sample)	18,933	44,303	962,666

observations (technically consider them as "missing") in each year that a person obtains social benefits, disability- or retirement pensions, or has earnings below/above a min/max threshold. The thresholds are chosen so as to censor extraordinarily high and negative earnings observations symmetrically: We remove the 0.5% lowest and highest observations in the total sample, which amount to a lower and upper thresholds of NOK 10,000 and NOK 2,500,000, respectively.

Some descriptive statistics are shown in Tables 2-3. Table 2 shows that the distribution of education levels is quite similar across types of entrepreneurship. A noticeable exception is the larger fraction of entrepreneurs within higher tertiary education or Phd (18 years or more). Table 3 shows the survival rates of both self-employed (S) and incorporated (I) entrepreneurship by year of entry into entrepreneurship. Exit from entrepreneurship means that all the entrepreneur's firms are entirely closed down or have become inactive.[15] The table indicates that about 50% of the incorporated entrepreneurship episodes lasts 10 years or more, compared to 40% for the (initially) self-employed entrepreneurs. These differences seem to be quite consistent over time, independent of the start-up year of entrepreneurship. Note that these survival percentages are higher than the usual ones due to the exclusion of necessity entrepreneurs from the sample.

[15] The exit year is the first year when the entrepreneur is no longer the sole proprietor *or* owner of any active firm which he/she has founded as an entrepreneur.

Table 3: **Survival rates of incorporated (I) and self-employed (S) entrepreneurship.** By year of entry into entrepreneurship

Year	Entry-year of entrepreneurship									
	2002		2004		2006		2008		2010	
	I	S	I	S	I	S	I	S	I	S
2002	1.00	1.00								
2003	0.90	0.99								
2004	0.86	0.87	1.00	1.00						
2005	0.78	0.75	0.89	0.96						
2006	0.71	0.69	0.79	0.86	1.00	1.00				
2007	0.67	0.58	0.72	0.70	0.90	0.93				
2008	0.63	0.55	0.65	0.64	0.84	0.85	1.00	1.00		
2009	0.55	0.49	0.58	0.54	0.76	0.72	0.91	0.93		
2010	0.53	0.43	0.55	0.47	0.71	0.60	0.85	0.82	1.00	1.00
2011	0.49	0.38	0.50	0.40	0.65	0.52	0.78	0.70	0.90	0.93

Propensity Score Matching (PSM) Before estimating the earnings equation, we match each of the two types of entrepreneurs (the two treatment groups), with corresponding control groups of wage earners by means of propensity score matching. Propensity score matching will ensure that the distribution of the vector of (observed) matching variables, S_i, is the same in both the treatment and control group, and that S_i will be independent of the treatment indicator, E_i, in the *matched* sample (of treated and controls), as shown by Rosenbaum and Rubin (1983). Matching reduces the sample size when estimating the model described in Section 2, which is necessary for computational feasibility, without significantly affecting the precision of the estimated treatment effects. An important additional advantage is that matching may alleviate biases if the functional form of S_i in the earnings equation is misspecified – for example if the earnings equation is linear in schooling, but (in reality) the marginal returns to schooling are decreasing.[16]

Our vector of matching variables, S_i, consists of all the *time-invariant* variables in Z_{1it} (see Table 5). The matching variables thus include a number of wealth, education and demographic variables, such as, for example *narrow* field of education (almost 100 categories), age and years of schooling – all variables measured in the first observation year 2001. Family entrepreneurship is well known to have a great effect on selection into entrepreneurship (Lindquist et al., 2015). Since, entrepreneurial parents may transmit their entrepreneurial talent, network or experience to their offspring, thereby enhancing their performance as entrepreneurs, a dummy identifying entrepreneurial parents is included in both S_i and Z_{2it} (the explanatory variables in the earnings equation). A partner's labour market characteristics may also impact an individual's labor market choices and performance. In particular, as supported by research from the US (see Bruce, 1999), we expect an individual with a partner who is already an (incorporated or self-employed) entrepreneur to be more

[16] Using PSM, the estimate of the treatment effects would still be unbiased in that case because years of schooling is independent of E_i in the *matched* sample. In the unmatched sample, however, the estimator will be biased if entrepreneurs on average are more (or less) educated than wage earners.

inclined to choose entrepreneurship. Hence we include a dummy of whether this is the case in S_i and Z_{2it}.

The matching procedure used is the STATA routine *psmatch2* with trimming. We use 1:5 nearest neighbors matching, but the matching algorithm sometimes finds less than 5 matches per entrepreneur.[17] The estimates are not sensitive to the choice of number of neighbors.

4 Results

The choice to become entrepreneur Tables 4-5 show the results for the random effects probit equations of the choice to become an incorporated or self-employed entrepreneur, given the initial state of full time employment (in 2001). The components of Z_{1it} can be grouped into five types of explanatory variables: i) variables regarding the individual's initial condition (in 2001), including region of origin, gender, household wealth, years of schooling and field of education; ii) age (both linear and quadratic terms); iii) calendar year dummies (for the each year of possible transition); iv) initial family and household characteristics, represented by dummies for whether the person is married/cohabiting and whether he/she has a partner or parent who is (already) an entrepreneur; and v) the identifying instruments: a set of dummy variable indicating number of years before/after inheritance (individuals not obtaining any inheritance in our observation period will have all dummies equal to zero; see Table 4).

Table 4 shows estimation and statistical test results regarding our proposed instruments. Admittedly, as discussed in the Introduction, one problem with using inheritance as a "natural experiment", as advocated by inter alia Blanchflower and Oswald (1990) and Holtz Eakin et al. (1994), is that if the inheritance is expected, the bequest is already absorbed in the life cycle plan of the recipient and there may be little effect of the actual transfer. Thus, we may have a problem of weak instruments. An additional concern is that bequests may have a direct effect on earnings through the wealth effect. To separate the effect of the timing of inheritance on the probability to become entrepreneur, on the one side, and the potential effect of the bequest on the individual's earnings, on the other, we include in Z_{2it} (i.e., in the vector of control variables in the earnings equation) the *size* of the inheritance relative to the initial wealth as a control variable. The wealth effect has been discussed extensively in the entrepreneurship literature. Higher wealth (actual or anticipated) could cause more entries into entrepreneurship motivated by non-pecuniary factors, e.g., if entrepreneurship is viewed as a consumption good (see Hurst and Lusardi, 2004, and Astebro and Thompson, 2011), or provide more insurance against failure (Evans and Jovanovic, 1989). The wealth effect may therefore induce entry of poorer performing entrepreneurs and lower the returns. A possible opposite effect of inheritance on entrepreneurship earnings is that it could ease liquidity constraints and thus provide greater business operating efficiency for entrants (Evans and Jovanovic, 1989).

[17] See http://repec.org/bocode/p/psmatch2.html. The option specification we used is: neighbor(5) common trim(10). See Leuven and Sianesi (2003) for practical guidelines and technical details regarding the algorithm.

The results pertaining to the estimation of the choice equation, see Table 4, show vast differences in the impact of inheritances between incorporated entrepreneurship and self-employment: For incorporated entrepreneurship, the results support the hypothesis that the capital requirements mean that those who receive an inheritance increase their probability of starting up their own business afterwards. The opposite is the case for self-employment: the probability of becoming self-employed is reduced immediately upon obtaining a bequest. This confirms the result of Bø et. al. (2016): They find clear evidence of recipients using bequests to increase their leisure/reduce labor supply shortly after the transfer. For persons close to retirement they find strong reductions in labor supply, but also significant effects for younger inheritors. If self-employment and wage employment are close substitutes, it is not surprising in view of their result ("the Carnegie effect") that inheritance gives a *disincentive* for self-employment. For transitions into both incorporated and self-employed entrepreneurship, the dummy variables are jointly significant. Moreover, we reject the hypothesis that all the coefficients are *equal*: if so, it would be the sum of the dummy variables which is relevant to the entrepreneurship decision. Then it is not the timing of inheritance (within $[1, T]$), but whether a person inherits at all which matters. The results in Table 4 confirm that the instruments are relevant, as the F-statistic exceeds 4 (8 in the case of incorporated entrepreneurship).[18]

Estimation results with regard to the other variables in the choice equation are reported in Table 5. Since the coefficients themselves are difficult to interpret (being probit coefficients in annual transition probability functions), it is more informative to look at marginal effects. Table 5 displays estimated marginal effects (averaged across individuals) on the probability to become entrepreneur during the interval 2002-2011 with regard to the following time-invariant explanatory variables: gender, level of schooling, family and partner characteristics, initial household wealth and age. For incorporated entrepreneurship, initial wealth is one of the most significant predictors, but hardly of any importance at all for self-employment. The strongest predictor of entrepreneurship among the partner and family characteristics is whether or not the partner is an entrepreneur. Also, having a parent who is an entrepreneur is a strong predictor of entrepreneurship, especially self-employment. Having higher tertiary education is positively related to the estimated propensity to become entrepreneur, but the relation is not strongly significant for neither type of entrepreneurship.

Given the estimated random effects probit models, it is possible to derive average probabilities to become an entrepreneur during 2002-2011 for all individuals in a given category. Some noticeable numbers from such calculations (not tabulated) are: A male has on average a three and a half times higher probability of making the transition from employment to incorporated entrepreneurship than a female (2.5% vs 0.7%), and more than twice as high a probability of becoming self-employed (6.2% vs 2.5%).

[18] Note that the test for the relevance of the instruments, i.e., the Wald test reported in Table 4 (and the implied F-statistic), refers to the test that all the dummy-coefficients are *equal* – not that they are equal to zero. Thus the degree of freedom of the test i 8 despite there being 9 dummy variables pertaining to the timing of the bequest.

Table 4: **The random effects probit-model.** Estimates and test results regarding the instrumental variables

Dependent variable: Switch to becoming entrepreneur	Incorporated		Self-employed	
	Est	z	Est	z
Instrumental variables:				
Dummy 1: $\geq$ 4 years before bequest[1)]	-0.06	-3.3	0.01	0.0
Dummy 2: 3 years before	0.02	0.5	0.01	0.4
Dummy 3: 2 years before	-0.01	-0.2	0.03	1.3
Dummy 4: 1 year before	0.03	0.9	-0.01	-0.3
Dummy 5: year of bequest	-0.01	-0.3	-0.03	-1.1
Dummy 6: 1 year after	0.09	2.6	-0.12	-4.0
Dummy 7: 2 years after	0.14	3.7	-0.09	-2.6
Dummy 8: 3 years after	0.13	3.1	-0.02	-0.8
Dummy 9: $\geq$ 4 years after	0.15	5.8	-0.01	-0.4
Test of equality of dummy coeff.:				
W(8)[2)] (p-value)	68.1	(0.000)	32.1	(0.05)
Test of weak instruments				
F-statistic (p-value)[3)]	8.6	(0.000)	4.1	(0.05)
No. of individuals in sample	962,666		962,666	

[1)]Only inheritances larger than NOK 300,000 (EUR 25,000) and received between 1998 and 2011 are included when constructing the dummy variables. Individuals obtaining less than NOK 300,000 during the whole period will have all dummies equal to 0. [2)]W(d) is the Wald test-statistic with d d.f. [3)]F=W(8)/8.

The returns to entrepreneurship Table 6 depicts the income distribution in the two comparison groups in 2001, by tabulating, in each decile, average earnings (in NOK) together with the ratio of average earnings of the treatment and matched comparison group. The table shows that the matched groups of entrepreneurs and non-entrepreneurs do not have the same earnings distribution, whereas, by definition, they have the same distribution with respect to background characteristics. Before they become entrepreneurs, incorporated entrepreneurs have on average higher earnings than individuals in the control group *in all the deciles*, with average earnings ratios (relative earnings) varying between 1.07 and 1.39, and increasing monotonically from the fourth decile. On the other hand, self-employed entrepreneurs have about the same initial earnings as individuals in the control group in all deciles, except for the three highest ones, where the earnings ratio is increasing with the decile – from 1.05 to 1.12. Thus there seems to be a significant positive selection based on endogenous (unobserved) variables into incorporated entrepreneurship, but much less so in the case for self-employed entrepreneurs. This selection bias cannot (and should not) be removed by matching, as it is not due to exogenous variables.

The parameters of main interest in the earnings equation are those of Table 7. The table shows the key results with regard to the estimated treatment effects (ATT) and the control function accounting for selection, ξ_i. Results for the control variables, Z_{2it}, are depicted in Table A1 in the Appendix.

ATT is defined in (6) for the case of estimating one average treatment ef-

Table 5: **Estimated average marginal effects (AME) of the explanatory variables on the probability to become entrepreneur during 2002-2011, in percentage points. Estimates from random effects probit model**

Dependent variable: Switch to becoming entrepreneur[1)]	Incorporated		Self-employed	
	AME[2)]	z[3)]	AME	z
Female (dummy)	-1.94	-4.0	-3.31	-17.1
Level of schooling (ref: Primary and lower sec)				
Upper and post-secondary (11-13)	0.58	0.84	0.04	0.01
Lower tertiary (14-17)	1.02	1.40	-0.07	-0.08
Higher tertiary and Phd (18+)	1.28	1.80	1.90	2.61
Married or cohabiting (ref: single)	0.28	5.09	-0.06	-0.71
Parental entrepreneurship (dummy)	0.29	7.11	0.42	14.9
Partner is an entrepreneur (dummy)	0.36	11.6	1.90	12.2
log-wealth in 2001	0.41	16.8	0.14	7.42
Age in 2001:[4)]				
20-30 years	0.08	12.8	0.01	5.35
30-40 years	0.03	15.8	-0.01	-6.37
40-50 years	-0.03	-16.3	-0.12	-7.42
50-60 years	-0.09	-11.6	-0.18	-4.52
No. of individuals in sample	962,666		962,666	

[1)] In addition we have included dummy variables for narrow field of education, country-of- origin, calendar year and initial industry of employment (estimates are available upon request). [2)]Marginal effect in percentage points, averaged across individuals.[3)]Estimates of AME divided by standard errors.
[4)]Marginal effect of a one year increase in initial age (in 2001), averaged across individuals in the given age interval (based on a quadratic specification).

fect. However, the results in Table 7 distinguish between average treatment effects along three dimensions: The first dimension is with respect to incorporation or self-employment. The second dimension is with respect to gender: a full set of interaction effects with gender is included in the earnings equation. The estimated coefficients of this model are depicted in Table A1 in the Appendix. In the results in the first set of rows of Table 7 – corresponding to *all individuals* – no distinction is made between men and women with regard to the estimated treatment effects. The third dimension is with regard to whether or not a control function is included in the earnings equation to account for self-selection (corresponding to the columns headed "Yes" and "No")

As can be seen in Table 7, the estimated parameter *ATT (Incorporated)* when no distinction is made between males and females is 0.052 (with a z-value of 11.0), which corresponds to a 5 percent increase in earnings as a result of switching to (incorporated) entrepreneurship. All treatment effects are statistically significant. For incorporated start-ups, the estimated ATT is slightly higher for women than men (0.06 vs. 0.05).

Most interestingly, we find significantly negative returns to self-employment. The estimated $ATT(\textit{Self-employed})$ is -0.065, i.e., a negative return of more than 6

Table 6: **Average earnings in the treatment and control groups, and relative earnings between treatment and corresponding control group**. In 2001, by earnings decile

Earnings decile[1)]	Control group – earnings in NOK		Treatment group – relative earnings[2)]	
	Incorp-orated	Self-employed	Incorp-orated	Self-employed
1	160,063	146,808	1.08	0.99
2	223,427	204,792	1.07	1.00
3	254,782	239,058	1.08	1.01
4	279,284	263,299	1.10	1.02
5	303,300	285,951	1.11	1.02
6	329,929	309,994	1.14	1.03
7	363,188	338,869	1.17	1.03
8	410,298	377,859	1.22	1.05
9	487,511	442,244	1.28	1.07
10	685,497	616,882	1.39	1.12
No. of individuals (N)	71,576	154,956	18,933	44,303

[1)]The highest and lowest 0.5% of the earnings observations (in each of the two groups) are excluded.[2)]Mean earnings in treatment group relative to mean earnings control group, by decile in 2001

percent (which is highly significant, with a z-value of -34.7). The gender-specific ATT-estimates are -0.067 for men and -0.099 for women, where both are highly significant. All these results are perfectly consistent with the findings by Levine and Rubinstein (2016).

The coefficient of the control function $\xi_i(T_i^*)$ in Table 7 is a measure of the degree of selection by *absolute advantage* into entrepreneurship (cf. the discussion in Section 2). The positive estimates of around 0.06 for both genders (z-values of 38 and 17 for men and women, respectively), tell us that selection by absolute advantage strongly characterizes the selection into incorporated entrepreneurship, as was already suggested by the income statistics in Table 6. Persons who become entrepreneurs have *cet. par.* much higher earnings potential than wage-earners *irrespective* of their choice to become entrepreneurs. As a consequence, the average observed earnings differentials between entrepreneurs and non-entrepreneurs (OD) – everything else equal – is higher than the ATT (cf. (7)). If we exclude the control function $\xi_i(T_i^*)$ from the model, the estimated *ATT (Incorporated)* increases with about 2 percentage points. In contrast we find no evidence of selection by absolute advantage into self-employment. This was also suggested by the numbers in Table 6. In fact, the estimated coefficient of the control function, $\xi_i(T_i^*)$, is negative for male self-employed entrepreneurs (-0.006), and even slightly significant, with a z-value of -5.8. We conclude that there is a negative effect of general income ability on the propensity to become a self-employed entrepreneur, but that the magnitude of the effect is close to zero.

Table 7: **Estimated average treatment effects on the treated (ATT), by type of entrepreneurship, gender and with or without control function included**

Dependent variable: log-earnings	Startup type			
	Incorporated		Self-employed	
Control function included[1)]:	Yes	No	Yes	No
All individuals				
ATT	0.052	0.074	-0.065	-0.067
(z-value)	(11.0)	(16.4)	(-34.7)	(-36.1)
$\xi_i(T_i^*)$	0.058	–	-0.004	–
(z-value)	(41.2)	(–)	(-4.5)	(–)
No. of entrepreneurs	18,933		44,303	
Men				
ATT	0.051	0.072	-0.060	-0.062
(z-value)	(9.6)	(14.9)	(-28.7)	(-30.2)
$\xi_i(T_i^*)$	0.061	–	-0.006	–
(z-value)	(37.9)	(–)	(-5.8)	
No. of entrepreneurs	12,597		33,808	
Women				
ATT	0.062	0.073	-0.099	-0.098
(z-value)	(5.2)	(6.5)	(-22.3)	(-22.6)
$\xi_i(T_i^*)$	0.051	–	0.000	
(z-value)	(16.7)	(–)	(0.1)	
No. of entrepreneurs	6,336		10,495	

[1)]Control function derived from estimated probit model

Table 8: **Estimates of parameters pertaining to the second order moments of the earnings equation**

Dependent variable: log-earnings	Startup type	
	Incorporated	Self-employed
sd(log-earnings)|active entrepr, Z_{2it} [1)]	0.68	0.55
sd(log-earnings)|control group, Z_{2it} [2)]	0.41	0.43
Residual (u_{it}):		
AR-coefficient (ϕ)	0.59	0.55
sd(u_{it})	0.32	0.35
Random effect (ε_i^*)		
sd(ε_i^*|entrepreneurs)	0.32	0.29
sd(ε_i^*|control group)	0.26	0.26

[1)]Standard deviation of log-earnings for active entrepreneurs ($Ent(i,t) = 1$) conditional on control variables (Z_{2it})
[2)]Standard deviation of log-earnings in control group (E_i= 0), given Z_{2it}

Table 8 displays the results for the second order moments. In general, the standard deviations, denoted sd($\cdot$), of log-earnings for active entrepreneurs (that is, when $E(i,t) = 1$), are much higher than in the comparison groups ($E_i = 0$): 0.68 and 0.55 for incorporated and self-employed entrepreneurs, respectively, compared to 0.41 and 0.43 in the corresponding comparison groups. The estimated AR-coefficient (ϕ) in Table 8 (0.59 and 0.55) reveal a high degree of autocorrelation in the error term u_{it}.

The estimated coefficients of the control variables Z_{2it} in the earnings equation, are displayed in Table A.1 in the Appendix. Their signs and magnitudes are in line with expectations from the empirical literature. Years of schooling and years of experience are the most significant explanatory variables in the model. An additional year of schooling is associated with an earnings increase of an estimated 6-7 percent (slightly more for women than men). Years of experience has an inverted U-shaped relation with earnings. We see that there is a significantly negative impact from the interaction variable *financial crisis*$\times$*entrepreneur* (*financial crisis* is a dummy for 2008-2009) and that initial wealth (in 2001) has a positive impact on earnings in all years. For a given level of schooling, the highest earnings are observed in the education fields Social science and law and Business and administration. There are few notable differences between males and females or across entrepreneurship types, with respect to the impact of exogenous variables.

5 Conclusion

In this paper we have reconsidered the so-called 'entrepreneurial earnings puzzle', i.e., the finding – by most studies – of zero or negative returns to entrepreneurship. Our analyses have been based on two pillars: data improvements and model improvements. First, we have had the advantage of register data comprising the whole Norwegian labor population and all firms established in the period 2002-2011. Second, these data have allowed us to identify both sole proprietors and owners of incorporated firms and their ownership shares. Third, we have observed very de-

tailed measures of employment and entrepreneurship incomes in the registry. Our rich data have also allowed us to propose a uniform measure of (pretax) earnings for all individuals in the sample, whether self-employed, wage-employed, unemployed or owner-managers of incorporated firms. It consists of the sum of labor income from wages and self-employment, work-related cash transfers and owner income from incorporated firms in which the individual is an entrepreneur.

Our analyses have focused on 'positive entrepreneurship', i.e., the transition from full-time wage employment to entrepreneurship. We have also distinguished between unincorporated (self-employed) and incorporated entrepreneurs. When estimating the returns to entrepreneurship ('the average treatment effects on the treated'), our model has enabled us to take into account that the choice to become an entrepreneur is endogenous with respect to earnings prospects, using the timing of (any) inheritance transfer as an identifying instrument (exclusion restriction).

The main bulk of empirical results in economics journals pertain to self-employment and usually find zero or negative returns. In line with these findings, we found that the average return to entrepreneurship is significantly negative for individuals entering entrepreneurship through self-employment, even so when only considering opportunity entrepreneurs. On the other hand we found that persons who become entrepreneurs by establishing incorporated firms, increase their earnings by 5 percent on average by becoming entrepreneurs. The latter result is consistent with, but a bit lower than the findings in other studies of 'high end' entrepreneurs such as (variants of) incorporated entrepreneurship (Berglann et al., 2011; Hvide, 2009; Hvide and Panos, 2014; Levine and Rubinstein, 2016), or even billionaire entrepreneurs (Henrekson and Sanandaji, 2014). All these studies find positive returns to entrepreneurship. The "Average Treatment Effect on the Treated" that we estimate is net of selection effects based on absolute advantage that make the differences higher (and therefore more comparable to earlier studies that did not net these out).

Nevertheless, some of our results are surprising in view of comparable analyses on registry data, especially Berglann et al. (2011), who find that entrepreneurs are *overall* generously rewarded in Norway. One explanation of this discrepancy may be that they identify different entrepreneurs than us by effectively conditioning on future outcomes (i.e., that the entrepreneurship earnings is the 'most important' source of income). However, by conditioning on future outcomes, one does not capture the full *ex ante* risk and reward of the transition from wage employment to entrepreneurship.

One must be careful about drawing too stark policy implications from our results. While the OECD (2003; 2005) considers entrepreneurship as an important source of economic growth and innovation in the economy, our results indicate that there may not be much to gain in economic terms for the individual entrepreneur. In a country like Norway – with a high employment rate among both men and women – there may be less to gain both for the individual entrepreneur and society as a whole through small-scale entrepreneurship than in countries where there are more unemployed resources that may be mobilized into the labour market through self-employment. Our analyses indicate that, at least to the individual entrepreneur, the ordinary labor market may pay off just as well – at much less risk – than managing one's own business. Only a minority group of startups, the ones who start out as incorporated and probably more ambitiously, experience positive returns from moving out of

wage-employment to entrepreneurship. A challenging question is to what extent these entrepreneurs that reap private benefits from entrepreneurship also contribute benefits to society such as economic growth, innovation and labor demand. Evidence of such a (lack of) alignment between private and social benefits of entrepreneurship would be informative about the efficiency of the entrepreneurial labor market and the effectiveness of financial incentives that may be affected through tax and other policies.

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Appendix: Supplementary materials

Proof of Proposition 1 and expression for marginal effects

$$\begin{aligned} & E(\varepsilon_{1i}|T_i = t) \\ = & \frac{1}{P(T_i = t)} E\left(\varepsilon_{1i} 1\{e_{it} > -[Z_{1it}\gamma_1 + \sigma\varepsilon_{i1}]\} \prod_{s<t} 1\{e_{is} \leq -[Z_{1is}\gamma_1 + \sigma\varepsilon_{i1}]\}\right) \\ = & \frac{1}{P(T_i = t)} \int \varepsilon_{1i} \Phi(Z_{1it}\gamma_1 + \sigma\varepsilon_{1i}) \prod_{s<t} \Phi(-[Z_{1is}\gamma_1 + \sigma\varepsilon_{1i}]) \phi(\varepsilon_{1i}) d\varepsilon_{1i} \\ \equiv & \xi(t) \text{ for } t = 1, ..., T \end{aligned}$$

where

$$\begin{aligned} P(T_i = t) &= E\left(1\{e_{it} > -[Z_{1it}\gamma_1 + \sigma\varepsilon_{i1}]\} \prod_{s<t} 1\{e_{is} \leq -[Z_{1is}\gamma_1 + \sigma\varepsilon_{i1}]\}\right) \\ &= \int \Phi(Z_{1it}\gamma_1 + \sigma\varepsilon_{1i}) \prod_{s<t} \Phi(-[Z_{1it}\gamma_1 + \sigma\varepsilon_{1i}]) \phi(\varepsilon_{1i}) d\varepsilon_{1i} \end{aligned}$$

and

$$\begin{aligned} & E(\varepsilon_{1i}|T_i > T) \\ = & \frac{1}{P(T_i > T)} E\left(\prod_{s \leq T} 1\{e_{is} \leq -[Z_{1is}\gamma_1 + \sigma\varepsilon_{i1}]\}\right) \\ = & \frac{1}{P(T_i^* = 0)} \int \varepsilon_{1i} \prod_{s \leq T} \Phi(-[Z_{1is}\gamma_1 + \sigma\varepsilon_{1i}]) \phi(\varepsilon_{1i}) d\varepsilon_{1i} \\ \equiv & \xi(0) \end{aligned}$$

where

$$
\begin{aligned}
P(T_i^* &= 0) \equiv P(T_i > T) = E\left(\prod_{s \leq T} 1\{e_{is} \leq -\left[Z_{1is}\gamma_1 + \sigma\varepsilon_{i1}\right]\}\right) \\
&= \int \prod_{s \leq T} \Phi(-\left[Z_{1is}\gamma_1 + \sigma\varepsilon_{1i}\right])\phi(\varepsilon_{1i})d\varepsilon_{1i}
\end{aligned}
$$

This completes the proof. Note that for each individual in the sample, we can differentiate the formula

$$
P(E_i = 1) = 1 - \int \exp(\sum_{s \leq T} \ln \Phi(-\left[Z_{1is}\gamma_1 + \sigma\varepsilon_{1i}\right]))\phi(\varepsilon_{1i})d\varepsilon_{1i}
$$

to numerically calculate the marginal effects, $\partial P(E_i = 1)/\partial Z_{1i1}$, of changing any time invariant or predetermined explanatory variable Z_{1i1} (with $Z_{1i1} = Z_{1i2} = ...$) on the probability that $E_i = 1$ for any individual. ■

Table A.1: **Parameter estimates of control variables in earnings equation**

Dependent variable: log-earnings[1)]	Incorporated				Self-employed			
	Est.	z	[95%	CI]	Est.	z	[95%	CI]
Coefficients for men:								
Years of schooling	0.06	123.5	0.06	0.06	0.05	138.2	0.05	0.05
Years of experience	0.04	178.1	0.04	0.04	0.04	238.6	0.04	0.04
(Years of experience/10)^2	-0.08	-176.8	-0.08	-0.08	-0.07	-235.1	-0.07	-0.07
Field of education:								
General programmes	0	(ref)						
Humanities	-0.08	-12.4	-0.09	-0.07	-0.07	-18.6	-0.08	-0.07
Teacher training	0.00	-0.6	-0.02	0.01	0.00	0.5	-0.01	0.01
Social science and law	0.07	10.4	0.05	0.08	0.06	12.7	0.05	0.07
Business and adm.	0.13	41.3	0.12	0.13	0.11	44.5	0.10	0.11
Natural scienes	0.07	29.6	0.06	0.07	0.07	46.1	0.07	0.07
Health	0.04	6.9	0.03	0.05	0.07	18.4	0.06	0.08
Transport services.	0.10	22.6	0.09	0.11	0.07	23.7	0.07	0.08
Entrepreneur(dummy)#crisis	-0.05	-19.7	-0.06	-0.05	-0.02	-12.2	-0.02	-0.02
log-wealth in 2001	0.04	55.3	0.04	0.04	0.03	79.8	0.03	0.03
Parental entrepreneurship (dummy)	0.02	4.1	0.01	0.03	0.02	7.61	0.02	0.03
Partner is an entrepreneur (dummy)	0.03	3.1	0.01	0.03	0.02	4.61	0.02	0.03
Inheritance realtive to wealth in 2001	0.01	2.1	0.00	0.02	0.01	1.53	0.00	0.03
Coefficients for women:								
Dummy for being female	0.15	3.9	0.07	0.22	0.22	12.2	0.18	0.25
Years of schooling	0.07	58.9	0.07	0.07	0.05	86.9	0.05	0.05
Years of experience	0.02	50.6	0.02	0.03	0.03	89.7	0.03	0.03
(Years of experience/10)^2	-0.04	-42.1	-0.04	-0.03	-0.04	-75.3	-0.04	-0.04
Field of education:								
General programmes	-0.06	-2.6	-0.11	-0.02	0.01	1.0	-0.01	0.04
Humanities	-0.09	-3.9	-0.14	-0.05	0.00	0.1	-0.02	0.02
Teacher training	-0.05	-2.2	-0.10	-0.01	0.06	4.9	0.04	0.09
Social science and law	0.03	1.1	-0.02	0.08	0.12	9.3	0.09	0.14
Business and adm.	0.04	1.7	-0.01	0.09	0.10	8.6	0.08	0.13
Natural scienes	0.03	1.1	-0.02	0.07	0.12	10.0	0.10	0.15
Health	-0.02	-0.8	-0.07	0.03	0.07	5.9	0.05	0.10
Transport services.	-0.02	-0.6	-0.06	0.03	0.03	2.4	0.01	0.06
Entrepreneur(dummy)#crisis	-0.01	-3.5	-0.02	-0.01	-0.04	-15.5	-0.04	-0.03
log-wealth in 2001	0.04	24.4	0.03	0.04	0.03	36.9	0.02	0.03
Parental entrepreneurship (dummy)	0.01	3.1	0.01	0.03	0.02	3.61	0.02	0.03
Partner is an entrepreneur (dummy)	0.02	2.7	0.01	0.03	0.02	3.07	0.01	0.03
Inheritance realtive to wealth in 2001	0.02	5.1	0.01	0.03	0.02	7.61	0.02	0.03

[1)] Dummies for year and country-of-origin are included in the estimated model, but not shown